inflammation is often periarticular and extends along the sheaths of the tendons; more often the synovial membrane is affected. If fluid accumulates it rarely becomes purulent.

Osler describes several clinical forms.

(a) Arthralgic,—in which there are wandering pains about the joints.

(b) Polyarthritic,—in which several joints become swollen and tender.

(c) Acute gonorrheal arthritis,—in which a single articulation becomes suddenly involved, with severe pain and extensive edema.

(d) Chronic hydrarthrosis,—which is usually monarticular and very apt to involve the knee. It comes on without pain or swelling.

(e) Bursal and synovial form,—which attacks chiefly the tendons, the bursae and periosteum. The bursae of the patella, the olecranon and the tendo Achilles are most apt to be involved.

Gonorrheal exostoses of the os calcis usually occur between the ages of 18 and 30. Traumatism and occupation do not seem to be factors in their production. Some time after the urethral infection, usually from three to nine months, the patient complains of sharp, severe pains in one or both heels. The pain can be sharply localized in the center of the plantar surface of the heel and elicited only by weight bearing or direct pressure. The pain may incapacitate the patient. The gait is characteristic, the weight being borne by the ball of the foot with the heel raised. The os calcis is enlarged and thickened in most cases and the evidence of the radiogram establishes the diagnosis.

The liability of joint affections to recur as long as a focus of infection is present is illustrated by a case I now have under treatment.

Mr. A., age 32, traveling salesman. Always in perfect health until twelve years ago, when he contracted gonorrheal urethritis. This he treated by means of injections without much benefit for four weeks, then the left knee became involved. This was treated with salicylates, liniments, etc., and finally aspirated and was put in a cast. After being in the cast thirty days the pain became so intense on account of the reaccumulation of the fluid, that it had to be removed. After seven months of treatment he could again walk with a somewhat crippled joint. For four years he led a regular life and was free from trouble. Then after intercourse his discharge reappeared and with it an arthritis in the left hip, which lasted three months. Later on he noticed after intercourse a slight urethral secretion at times and has had the left knee, heel, cervical intervertebral and hip joints involved. One month ago he came to me complaining of stiffness in moving the jaw and a urethral discharge. On examination the secretion contained gonococci. A well-marked stricture of about 24 F. was found in the anterior urethra and the prostatic secretion contained many pus cells. He has developed arthritis of both tempora maxillary joints, as well as in the left knee and the metatarsal phalangeal joint of the great toe.

As all previous methods of treatment have been so unsatisfactory, we naturally turn to vaccine therapy as a panacea in these conditions. Although many good results have been obtained, still at times we are disappointed. Whether this is due to a worthless vaccine, a mixed infection or the attendant is often hard to determine. There is no doubt that autogenous vaccines are more effective than stock vaccines, but they are often impossible to obtain.

Drs. Eyre and Stewart, who have done a great deal of work with vaccines, claim that the doses generally used are too large and advocate the use of doses not to exceed 25 millions. In systemic infections a dose of 5 millions is given every five days. Where there is a joint involvement, in twelve to twenty-four hours after an injection, the affected joint becomes more painful and sometimes more swollen and red. These symptoms correspond to the negative phase. After 36 to 48 hours these symptoms clear up and the movements become much freer. A vaccine that can be used in large doses with no effect should be regarded with suspicion and the possibility of a mixed infection should not be overlooked. The use of hot air and passive hyperemia in joint conditions is an aid. The original focus should always receive attention.

ON THE RELIEF OF GLAUCOMA BY SUBCONJUNCTIVAL SODIUM CITRATE INJECTIONS.

By HAYWARD G. THOMAS, M. D., Oakland.

Pathologists and clinicians are agreed that glaucoma represents in essence a state in which the eye holds an increased amount of water. As we had best now regard it, it is in reality an edema, and the increased pressure brought about by this means accounts for all the clinical signs and symptoms observed in the condition. As generally held the increased amount of fluid contained in the eye in glaucoma is believed to be forced into the eye through such agencies as an increased influx or a diminished efflux of blood and lymph from the eye. The unsatisfactory nature of this idea is expressed in every text book of ophthalmology. Martin H. Fischer, in his work on edema, has given another interpretation of the phenomena observed. He maintains that the eye comes to hold an increased amount of water in glaucoma, not because more fluid is *forced* into the eye, but because changes take place within it which make it absorb more water than normal. He holds that the colloids determine the amount of water held by any tissue and defines glaucoma as a condition in which the normal affinity of the ocular colloids for water has been increased. This increase in the affinity of the colloids of the eye for water is brought about in either one or both of the following ways: First, through the production of acids within the eye; or second, through such changes in the colloids themselves as convert those having a low affinity for water into such as have a greater affinity. The necessary conditions for such an abnormal production of acids or such a change in the colloids of the eye are to be found in those illy grouped factors of arterio-sclerosis, syphilis, old age, primary inflammatory conditions, etc., that are generally looked upon as primarily responsible for glaucoma.

The clinical methods that we pursue in order to treat glaucoma divide themselves into the two groups of a systemic treatment which would combat an arterio-sclerosis, a syphilis, or what not, and a local treatment which in the aggregate is aimed at the mere reduction of tension within the eye. Upon this

local treatment especially great stress has of necessity at all times been laid, because of the disastrous results that follow the continuance of a high ocular tension for even a short period of time. Since Von Graefe's first writings on the subject iridectomy has been regarded as one of the best procedures to carry out in this condition. The years seem to indicate that this is not the ideal treatment for glaucoma. I may not be fortunate, but all the cases I have seen in my office or clinic, or in the county hospital, that have been operated on by various men are blind in the operated eye. Unless by accident a fistula into the subconjunctival space has persisted, an ordinary iridectomy does not seem to last long as a filtration project. In fact, an operation has recently been proposed for the purpose of producing such a permanent opening between the anterior chamber and the subconjunctival space. But making a leak hole in the anterior structure of the eye is a temporizing affair and at best a makeshift.

The fact that surgical procedures cannot always be carried out and that even when they can, iridectomies, sclerotomies, cyclodialyses, etc., do not give that permanent relief which is desired, has found expression in the more conservative methods of treating glaucoma that have been favored more recently. Hence the urging that we rely more assiduously on eserin, pilocarpin and dionin. But every ophthalmologist has all too often been confronted with glaucomas in which these means have proved entirely unavailing.

During the past year and half I have been using subconjunctival injections of sodium citrate to reduce the tension. Its use was suggested by the antagonism discovered to exist between the effect of acids and neutral salts on the imbibition of water by colloids. The method consists in the injection of from 5 to 15 drops of a 4.05% to a 5.41% solution of the chemically pure crystallized sodium citrate, preceded by the instillation of a cocain and an adrenalin solution into the conjunctival sac. During this time I have treated in all nine cases of primary glaucoma, and two of secondary glaucoma. All but one occurred in women. As a group the primary cases were in individuals over forty-five, and concerned thin, illy nourished women of sedentary habits. The effect of these injections in reducing tension was unfailing and without evil consequences. After each injection there was a relief of the symptoms of glaucoma for from three days to several weeks. The advantages of these subconjunctival sodium citrate injections over the other recognized surgical or medical procedures are evidently to be sought in their simplicity and in the promptness with which they produce results. Clearly these injections do not constitute a "cure" for glaucoma, but no more do iridectomies, sclerotomies, or any other procedures which merely aim to reduce tension. The cure for glaucoma clearly resides in the removal of those conditions which primarily led to the chemical changes within the eye which increased the affinity of the ocular colloids for water.

I would like to add a word regarding the cloudiness of the cornea observed in glaucoma. Fischer has found that this is not an edema, of the cornea, but represents a precipitation of certain of the protein elements of the cornea. The same seems to be true of such opacities of the lens as are typified, for example by the ordinary senile cataract. In using the sodium citrate injections for the treatment of glaucoma, I found that lenticular opacities cleared up remarkably. A number of the cases that I have treated in this way will form the nucleus of a paper on cataract absorption. Such a result was anticipated because precipitates of the protein are partially reversible.

Discussion.

Dr. Martin Fischer, Oakland: I have been much interested in the remarks made here this afternoon, especially in the attempts to produce experimental glaucoma in living animals through the injection of acids into the eye. Dr. Franklin got a distinct rise in tension sometimes, and sometimes his injections were without apparent effect. The matter is, I think, easily explained. In judging of the effects of such procedure two things must be borne in mind,—first, the direct effect of the acid upon the ocular colloids; second, the inflammation that may be induced by the acid, and the effects of the chemical changes characteristic of an inflammation in affecting the colloids. If one of these consists in the production of acids in the tissues, then the effect of this acid is clearly added to the effect of that which has been injected. One need not be surprised to see that the direct injection of acid into the eye is not always followed by a glaucoma. Under normal circumstances, what we might call the immunity of the tissues to acids is very high. If now the injected acid is not too strong, and not too large in amount, the circulation through the eye may very well be able to absorb it all so quickly that no glaucoma, or only a very slight temporary rise in tension may result. I would suggest that these acid injection experiments be repeated in conjunction with some procedure which makes a rapid absorption less easily possible, such for example as ligation of the arteries supplying the eye. How rapidly the body is able to take care of an injected acid is clearly evidenced by the artificial wheals (urticaria) which I showed can be produced by stabbing the skin with a hypodermic needle dipped in formic acid. The wheals so produced come and go very quickly. The question was raised as to whether a so-called primary glaucoma is any different from a secondary glaucoma. Pathologically there is, of course, no difference, for a glaucoma for which we know the cause, and a glaucoma for which we do not know the cause, are in essence the same. Glaucoma is only an edema of the eye-ball, and an edema is an edema no matter what the cause. The classification of glaucoma into primary and secondary glaucoma, and the former of these into simple glaucoma, inflammatory glaucoma, etc., has come to us from Fuchs' first treatise on the eye, and represents a clinical classification which tries not only to take cognizance of an etiology for glaucoma, but clinical appearance as well. This is of course arbitrary. The whole matter is similar to the manifestation of hernia, with which, as you know, glaucoma has been compared before this. If a knuckle of intestine should become twisted and develop a slight edema with various accompanying symptoms, and we did not know that the twist with a pinching of certain blood vessels lay at the bottom of the whole matter we would have what in the eye would be called a simple glaucoma. If the twist was more severe and the interference with the circulation greater, then the edema would be greater, the congestion greater, extravasations of the blood might occur, and various signs indicative of an inflammation. In the eye this would be called inflammatory glaucoma, yet there is no difference except in degree between the two pictures of the strangulated gut that have been here represented. Finally, if from any cause a very ap-

parent pathological change would set in in the knuckle of intestine under discussion, say an infection of the intestinal wall, and in consequence of the inflammation so produced, the gut should be found to swell (an inflammatory edema), then this would correspond with the picture of the secondary glaucoma. In other words, so far as the edema is concerned, which is the essence of glaucoma, it does not matter whether this is of unknown origin, or accompanied by particularly striking secondary manifestations, or the accompaniment of a frank pathological change, any more than it matters so far as the edema itself is concerned whether a man's legs are swelled from a heat lesion, or from a local erysipelas infection. I was much interested in the remarks about spontaneous glaucoma, and the fact that this occurs in rabbits. Anyone who has ever been interested in what rabbits are fed will know that great carelessness exists in the feeding of laboratory animals. Insteads of being given a good mixed diet, they are too often fed a so-called one-sided diet, one chiefly consisting of oats, or wheat or what not. Under these circumstances the animals develop an acidosis and a scurvy, and scurvy is characterized by the development of edema. Holst and Froelich, who have made extensive experiments on this subject, noted constantly marked edema in their scorbutic animals. William B. Wherry repeated some of these experiments about a year ago, and was kind enough to show me his results. In one of his rabbits he noted a marked glaucoma in both eyes.

Dr. Kaspar Pischel, San Francisco: After I had read Dr. Martin Fischer's interesting publications about his ingenious experiments. I became convinced that they meant a big step forward toward the solution of this puzzle. After consultation with Dr. Thomas, regarding strength and dosage, I immediately tried sodium citrate in every available case of glaucoma. I hope you all have tried it and will report your results. I made 10 injections in all; in 4 eyes with simple glaucoma I injected 0.1 to 0.2 of a 2½% solution without apparent result. But the patients complained so much about the pain that I could not try it again. In a case of glaucoma absolutum I made 4 injections 0.2 and 0.3 of a 2½ and 5% solution. Only the very first time after the smallest and weakest injection I noticed a slight reduction of tension. I am sorry that the results in my cases were not encouraging but I will try it again with larger doses.

Dr. Hayward G. Thomas, Oakland: In the 11 cases I have treated, I have given probably between three and four hundred injections, and have always observed prompt reduction of tension. One old man I saw for the first time 10 years ago. One eye was blind from glaucoma, inflamed and painful. He refused to have anything done for it. A short time ago he came with glaucoma of the other eye: T+2, vision 12/100. I immediately began injections and continued them weekly and bi-weekly. The reduction in tension was marked, and the vision in the good eye is now 20/40. As a matter of experiment, I injected the blind eye which has a cataract. The tension has come down very considerably, and the cataract shows a marked decrease in opacity. A patient from the country came into my office weekly for the injections. They were always followed by great reduction in tension, accompanying which the patient had a feeling of well-being. During these intervals she would feel happy, and be able to attend to her household duties. With return of the tension would return the depressed feeling. When I first used these sodium citrate injections, I had the old fear regarding the filtration angle, and so would use a drop of eserin to counteract any influence the cocain and adrenalin might have in dilating the pupil. I got over my fears when one day a nurse came to me and with horror told me she had by mistake used atropin in a glaucomatous eye. There was a mild panic in the office immediately, but I went ahead and used the sodium citrate; the tension came down immediately, and though there was dilatation and the usual cycoplegic effect for nearly a week, the tension did not rise and no ill results followed. In another case, that of a woman, thin, nervous, anxious, depressed, with both eyes glaucomatous and marked diminution of vision and field in one eye, I began injections, gradually increasing from 2% to 4% solution. This patient's sight and field became normal. Her general health improved greatly, as was evidenced by a gain of more than 10 pounds in a few months. The reason for Dr. Pischel's failure to get a reduction in tension is to be found in the fact that the solutions he injected were neither concentrated enough, nor sufficient in quantity. The ordinary case of glaucoma demands the injection of 10 to 15 drops of the 5% solution. The pain after such injections, while at times severe, does not last long, only 3 to 4 minutes as a rule.

Dr. Walter Scott Franklin, San Francisco: I agree with what Dr. Fischer has said in explanation of the rapid distribution of acid. It is necessary for us to find a method of keeping the eye in an acid media for a long time. Experiments seem to show that glaucoma is a stoppage of the filtration angle. Replying to Dr. Cohn, I did not inject bland oil in the eye; I prefer olive oil to the injection of ammonia, which is very irritating. Dr. Fischer's explanation of the rapid absorption of the acid certainly accounts for the fact of no hypertension being produced.

OPERATIVE TREATMENT OF FRACTURES OF THE NECK OF THE FEMUR.*

By S. J. HUNKIN, M. D., San Francisco.

Believing that the ordinary text-book teaching regarding the surgical treatment of fractures of the neck of the femur is bad, and believing also that results compared with those attained in other femoral fractures will follow better planned surgical treatment, is my excuse for this offering.

Orthopedic surgeons of late years have not been remiss in voicing opinions as to the advisability and efficiency of proper surgical procedures in such cases, but the ideas of the general surgeon ordinarily have prevailed, and they have taught that the surgical treatment of fractures of the femoral neck is in the vast majority of instances of no avail. Looking upon these fractures as pertaining to old age and fearing decubitus, delirium, pneumonia, and death, if confinement was insisted upon, and not believing union to occur under the best controlled conditions often enough to interfere with the rule, his opinion prevented any efficient action. The trusting patient then generally got little surgical attention and that little has usually been bad. The evidence of the last few years, however, and especially so since the common use of the Crookes' tube, has shown that fractures of the neck of the femur are not so rare in the young adult and are not unknown even in childhood. (Five instances of the latter have come under my personal observation.) Moreover, the "let alone" policy, or the little better policy of inefficient traction, combined or not with sand bags, or a padded bar, is not good surgery. May I here be permitted to state my conviction that in the large majority of recent fractures of the femoral neck in either the young or the old, repair, union and efficiency under ordinary careful surgical procedures, thoroughly carried out to the end, may generally be expected and secured. I believe also that proba-

* Read before the California Academy of Medicine.